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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/328,939	06/09/1999	SHUZO FUJIMURA	18867-000410	7514

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EXAMINER

AHMED, SHAMIM

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/328,939	Applicant(s) FUJIMURA ET AL.	
	Examiner Shamim Ahmed	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 January 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5,9-11,21 and 23-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5,9-11,21 and 23-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/28/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 1/26/04 have been fully considered but they are not persuasive. Applicants argue that Moslehi (5,089,441) do not teach the flow rate ratio of hydrogen in gas-B to that in gas-A is larger than 1/480.

The argument is not persuasive because Moslehi teaches the flow ratio of gas-B (HCl) to that of gas-A (H₂) is less than 50 sccm: 12000 sccm that equals 4.167×10^{-3} and falls in the claimed range of larger than 1/480 (2.08×10^{-3}).

Examiner also point out that the claim does not limit that the amount of hydrogen is in the form of hydrogen atom or diatomic hydrogen and furthermore, Moslehi's flow ratio of hydrogen gas already in the form of hydrogen molecule. Therefore, it is not necessary to multiply the flow rate of hydrogen by two.

Applicants also argue that Moslehi fails to show the surface treatment in a substantially downstream position of a plasma source.

The argument is not persuasive because Moslehi shows that the substrate (15) to be treated is in the downstream position of a plasma source (24) (see figure 1).

Response to Amendment

2. The amendment filed on 1/26/04 is sufficient to overcome the 112, first paragraph rejection of the previous office action mailed 7/25/03 The pending claims are still rejected as follows.

Claim Objections

3. Claim 1 is objected to because of the following informalities: It is noted that the amendment to claim 1, line 6, is intended to delete "a", which is unnecessary because the claim 1, lines 6, does not include "a" twice (see the claim filed on 3/24/03).

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1 –2,5, 9 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Moslehi (USP 5,089,441).

Moslehi teaches a dry cleaning process, wherein a gas mixture of hydrogen gas and a halogen containing gas such as HCl or HBr or HF is used to enhance the cleaning process, assuming hydrogen is Gas-A and a Gas-B including a halide (col.7, lines 9-18).

Moslehi teaches that the flow rate of HCl: H₂ is less than about 50 sccm: 12000 sccm (col.5, lines 15-20).

So, Moslehi teaches the limitation of an amount of hydrogen in gas-B (HCl) to that in gas-A (H₂) is larger than 1/480.

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As to claim 2, Moslehi teaches that some of the gases can be introduced in the downstream of the plasma as non-plasma state into the process chamber, assuming Gas-D (col.5, lines 10-20).

As to the claims 9 and 11, Moslehi teaches HF and silane are introduced as a process gas (col.7, lines 10-18 and 54-60).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Moslehi in view of Grill (Cold Plasma in Materials Fabrication).

Moslehi discussed in the above paragraph No. 4 but fails to teach the introduction of a gas containing carbon as its element in the downstream of the plasma.

However, Grill discloses an etching process of removing silicon oxide utilizing a gas mixture of hydrogen and CF₄, which is well known in the art (page 230-231 and table 8-2).

Therefore, it would have been obvious to one skill in the art at the time of claimed invention to combine Grill's teaching into Moslehi's method because this is conventional to use a gas containing carbon element as taught by Grill.

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8. Claims 1-2, 5 and 23-25 and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi (5,620,559) in view of Lerner et al (5,007,983), and further in view of Hills et al (5,744,049).

Kikuchi discloses a surface treatment process, wherein a gas mixture of hydrogen and water vapor is used to create a plasma, assuming hydrogen is Gas-A and a Gas-B including water vapor (col.3, lines 54-60 and figure 1).

Kikuchi fails to teach that the gas-B comprises a halogen and a hydrogen bearing species.

However, in a plasma etching process, Lerner et al teach that halogen gases such as chlorine or fluorine can be substitute by water vapor because both the halogen gas and the water vapor are functionally equivalent (col.4, lines 57-65).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to include Lerner et al's teaching into Kikuchi's process for substituting the water vapor with chlorine gas because both the chlorine and water vapor are functionally equivalent in a plasma etching process as taught by Lerner et al.

Modified Kikuchi, still does not teach that the gas-B comprises a halogen and a hydrogen bearing species.

However, Hills et al teaches that a hydrogen bearing gas such as HBr can be added to halogen such as chlorine for increasing the etching uniformity of the plasma ion density across the surface of the substrate (col.4, lines 28-35).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Hills et al's teaching into modified Kikuchi's process for

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increasing the etching uniformity of the plasma ion density across the surface of the substrate as taught by Hills et al.

Kikuchi also discloses that the ratio of the gas flow of the mixed gas is maintained at a desired value (col.3, lines 65-67).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to optimize the ratio, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

As to claims 2, 24,28, Kikuchi teaches that a gas-D including NF_3 is injected in the downstream of the plasma (col.4, lines 17-26).

9. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi (5,620,559) in view of Lerner et al (5,007,983) as applied to claims 1-2, 5 and 23-25 and 28-29 above, and further in view of Watatani et al (5,620,526).

Modified Kikuchi discussed in the paragraph 7 above, but fails to teach that the gas-D could comprises a gas containing silicon.

However, in a method of cleaning, Watatani et al teach that both the NF_3 and silicon containing gas such as SiH_4 can be used for treatment with enhancing the cleaning capability by removing adhered chemicals onto the substrate (col.3, lines 40-50).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Watatani et al's teaching of functional equivalency of NH_3

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and SiH_4 into modified Kikuchi's process for enhancing the cleaning capability by removing adhered chemicals onto the substrate as taught by Watatani et al.

10. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi (5,620,559) in view of Lerner et al (5,007,983) as applied to claims 1-2, 5 and 23-25 and 28-29 above, and further in view of Barth (5,763,326).

Modified Kikuchi discussed in the paragraph 7 above, but fails to teach that the gas-D could comprises a gas containing carbon as an element.

However, in a method of plasma etching process for cleaning semiconductor devices, Barth teaches that NF_3 and carbon containing gas such as CF_4 are functionally equivalent for efficient cleaning (col.2, lines 4-6 and col.3, lines 13-16).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Barth's teaching of functional equivalency of NH_3 and CF_4 into modified Kikuchi's process for efficient cleaning.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shamim Ahmed whose telephone number is (571) 272-1457. The examiner can normally be reached on M-Thu (7:00-5:30) Every Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shamim Ahmed
Examiner
Art Unit 1765

SA
April 1, 2004

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

